THE RELIABILITY OF HUMAN EXPOSURE MODELS: HUMAN VARIABILITY VERSUS ESTIMATION ERRORS AS SOURCES OF UNCERTAINTY

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In a comprehensive human exposure modeling framework, we assess exposures from several potential pathways. This framework provides multiple and competing links between potential dose and contaminant concentrations in multiple environmental media; and requires three types of input—intermedia transfer factors (ITFs), human contact factors (CFs), and human activity patterns (HAPs). ITFs describe the transfer of contaminants from environmental media to exposure media, i.e. from soil to house dust, from tap water to indoor air, from soil and air to homegrown foods, etc. CFs describe the level of contact humans have with exposure media, i.e. breathing rates, soil loading on skin, chemical permeability from water to skin, ingestion rates of different food types, etc. HAPs describe the frequency and duration of the activities that give rise to exposure media contacts. The statistical variance in parameters describing ITFs are primarily due to estimation and measurement error, whereas the statistical variance in HAPs comes from human variability, and the variance in CFs involves both human variability and estimation/measurement errors. Using exposures through dermal contact and through homegrown food as case studies, we will examine the relative significance of statistical variance in HAPs, ITFs, and CFs in terms of impact on the reliability of human exposure models. We will consider a strategy based on sensitivity/uncertainty analysis to allocate resources to improve the precision in each input category.

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